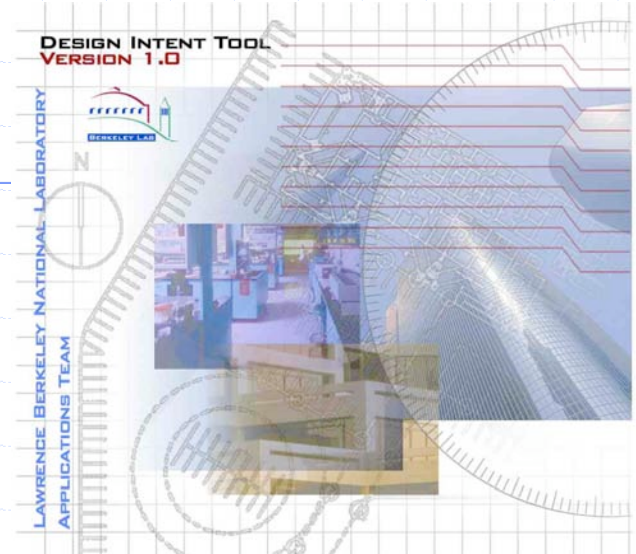
Design Intent Tool



Facilitating collaboration & lifecycle information management in energy-efficient buildings

Lawrence Berkeley National Laboratory • Applications Team

Sponsored by the California Energy Commission

Presentation to Labs21

Dale Sartor & Evan Mills

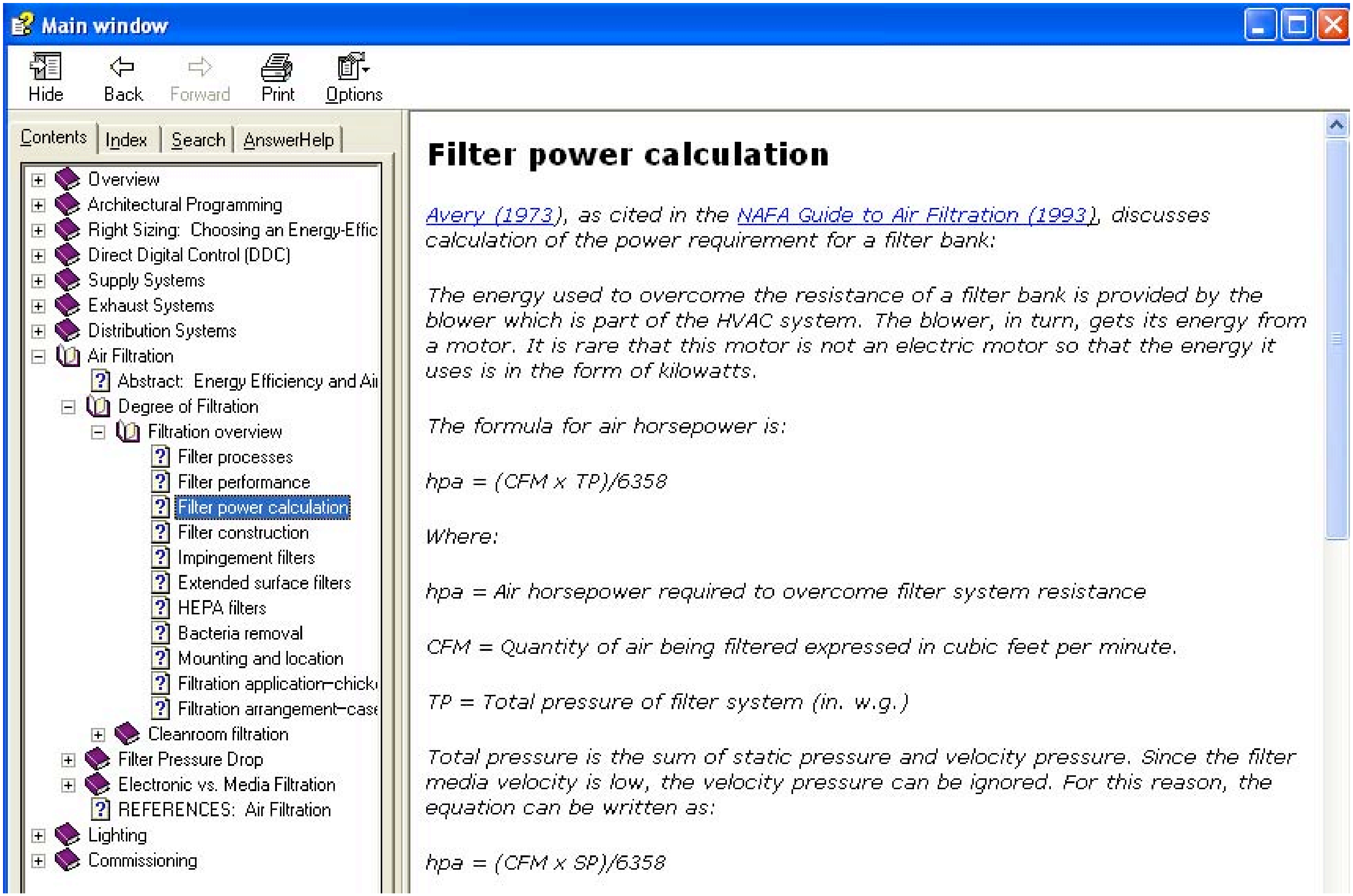
Labs21 Design Support Tools

An Overview

Labs21 Design Support Tools

Lab Design Guide *Reference Manual & How-to Manual*	Online guidance on how to implement high performance strategies
Design Intent Tool	A database tool to document intended strategies and metrics during design
Environmental Performance Criteria	A point-based system to rate overall sustainability
Benchmarking Tool	A web-based database tool to compare energy performance across facilities

Lab Design Guide – Reference Manual



Lab Design Guide – How-to Manual (under development)

LABS FOR THE 21ST CENTURY

Lab Design Guide: How-to Manual

The How-to Manual provides "step-by-step" guidance on energy efficiency and sustainability measures at various phases of the design process, from pre-design, through design development, construction and occupancy. The manual emphasizes energy efficiency and sustainability measures that are especially relevant in laboratories. More general measures (e.g. efficient lighting in office spaces in laboratory buildings) are briefly mentioned but not detailed, since these are well covered in other referenced resources.

Process — ***Start here. This section lists a series of process-related action items for each stage of the design process***

Strategies — ***This section describes how to implement objectives and strategies, with action items for each design stage***

This manual should be used in conjunction with the following Labs21 tools:

Lab Design Guide-Reference: This serves as a detailed reference for the How-to Manual, and provides links to the Reference. There is some overlap of content to facilitate the linkages.

Lab Design Intent Tool: The design intent documentation tool should be used to document and track energy, efficiency objectives, strategies used to achieve objectives, and performance metrics to measure success.

Benchmarking Tool: The benchmarking tool should be used to set targets and benchmark energy performance.

Environmental Performance Criteria: The EPC should be used to document and track the overall rating of the laboratory as the design progresses.

LABS FOR THE 21ST CENTURY

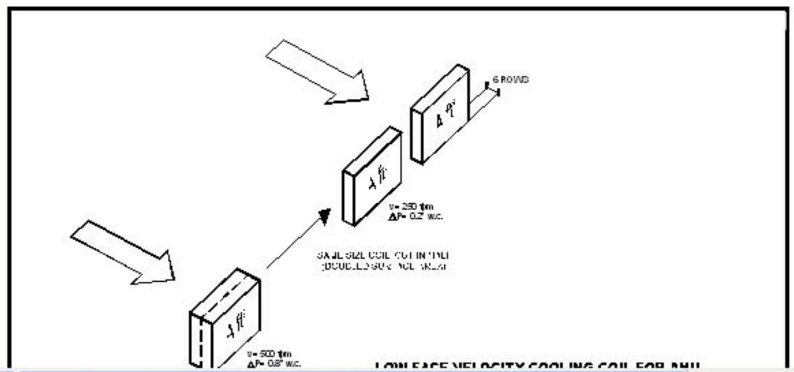
Low Pressure Drop Coils

Adapted from "How Low Can you Go? Low Pressure Drop Laboratory Design", by Dale Sartor, John Weale

Description

Traditional air handler design for office buildings sets the size of the air handler based on a face velocity of 500 fpm. Originally based on balancing the first cost with the lifetime energy cost of equipment, this decades-old rule of thumb face velocity was never intended for sizing a unit that operates 8,760 hour per year, and is now rather questionable even for sizing standard modern office units. The reason the face velocity is so important is it has a direct impact on the energy consumption of the air handler.

By selecting a lower face velocity, the pressure drop of the air handling unit, and the proportional energy consumption, is reduced. As described in the picture below, a reduction in the face velocity reduces the power requirement by the square of the velocity reduction, for example a 25% reduction in face velocity yields a 44% reduction in power requirement.



Benchmarking Tool

(under development)

Labs21 Benchmarking Database
Data Collection Form v0.1

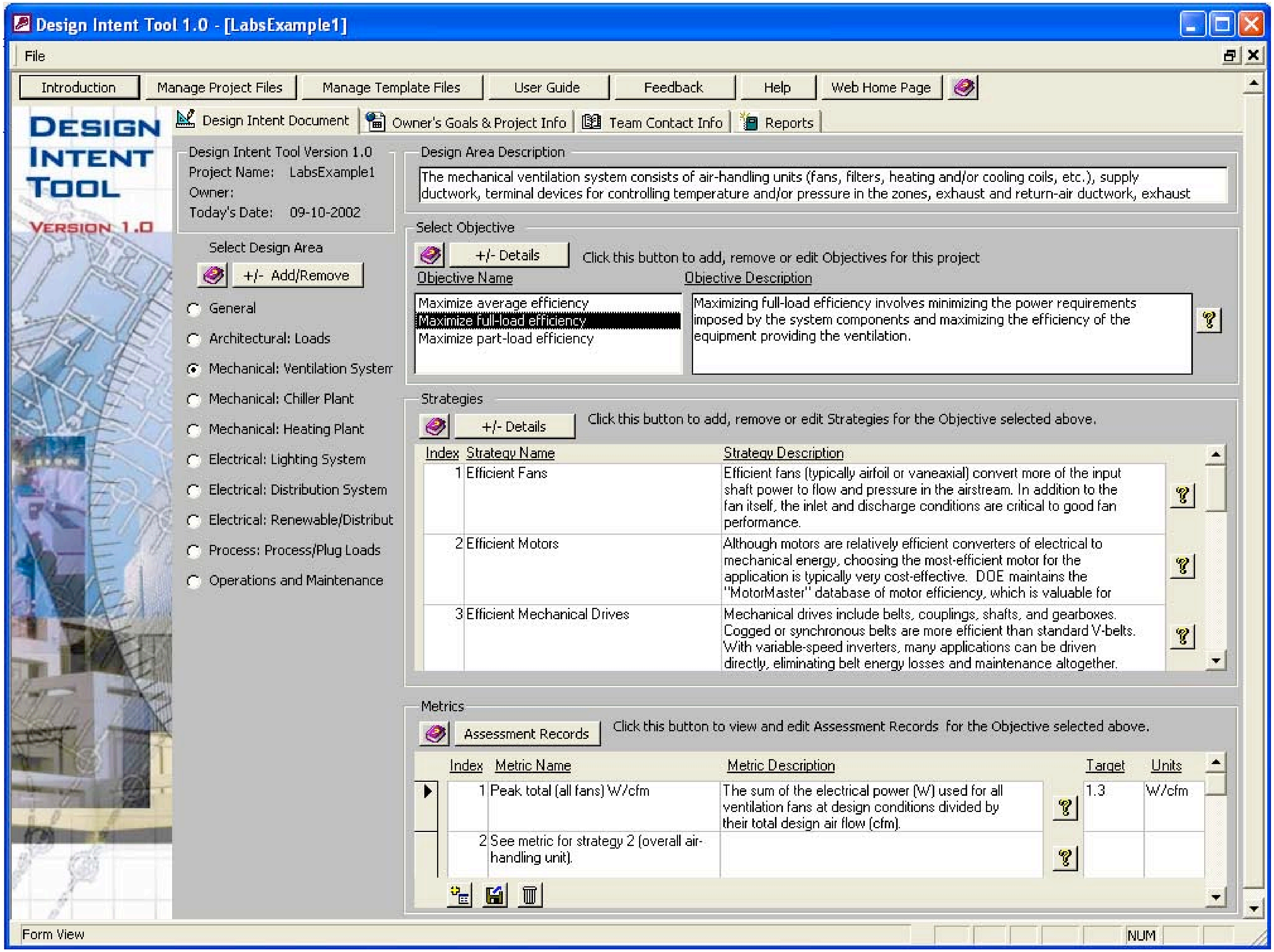
Go to Main Page

* Priority 1 Data
* Priority 2 Data
Priority 3 Data

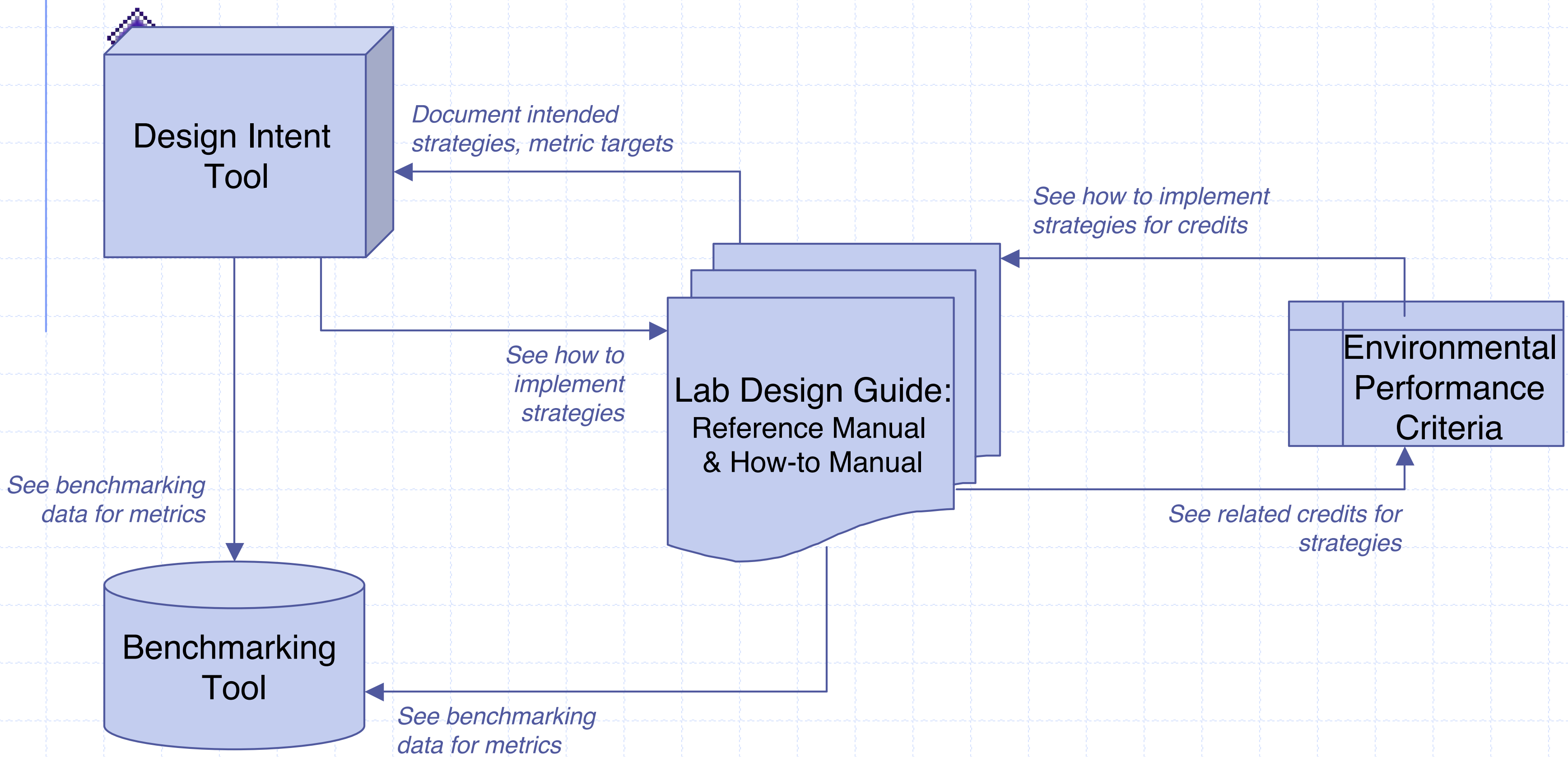
		Value	Comment/Explanation
	General Facility Data		
*	Facility Name	Fred Hutchinson Cancer Research Center	
*	Street Address	1100 Fairview Ave.	
*	Location	Seattle, WA	
*	ZIP Code	98109	
*	Lab Use	Research/ Development	
*	Lab Type	Biological	
*	Lab Category	Wet Lab	
*	Number of Buildings	3	Phase 1 has 2 bldgs, and phase 2 has 1 bldg
*	Gross Area (sq.ft)	532,602	
*	Lab Area (sq.ft)	105,665	
	Weekday Occupancy Hours	11	8 am to 7 pm is regarded as "occupied hours"
	Year built	1997	phase 1 in 1993, phase 2 in 1997
	Energy Use Data		
*	Annual Energy Utility Costs ($)	1,390,091	$2.61/ gross sf (utility bill data)
*	Ann. Heating Energy (therms)	963,667	utility bill data
	Does facility use CHP (Cogen) system?		
	Annual Electricity Use (kWh)		
*	Total building(s)	41,010,354	based on design data, actual for 2000-2001 was 25,937,717
*	Ventilation	19,067,152	based on design data
*	Cooling Plant	4,686,898	based on design data
	Lighting	3,408,653	based on design data
	Process/plug	13,847,652	based on design data
	Peak demand (kW)		

System	Energy Use Metrics	Efficiency Metrics
Ventilation	kWh/sf-yr	Peak W/cfm Peak cfm/sf (lab) Avg cfm/peak
Cooling	kWh/sf-yr	Peak W/sf Avg kW/ton Peak tons/sf
Lighting	kWh/sf-yr	Peak W/sf
Process/ Plug	kWh/sf-yr	Peak W/sf
Heating	BTU/sf-yr	Peak W/sf Utility $/sf-yr
Aggregate	kWh/sf-yr BTU/sf-yr (source)	Effectiveness (Ideal BTU/ Actual BTU)

Design Intent Tool



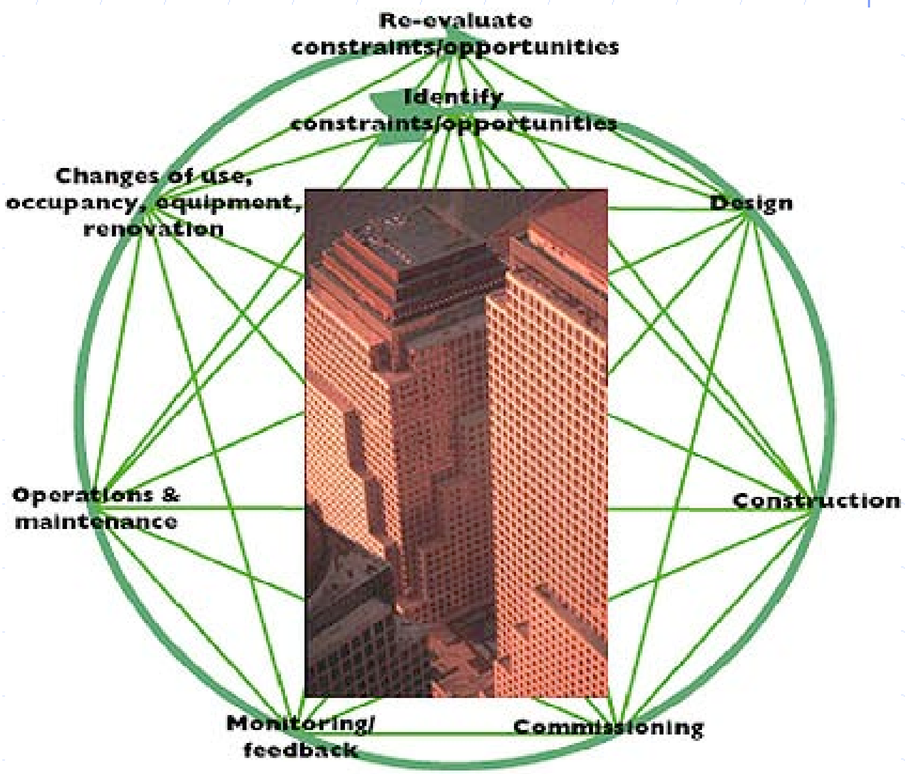
Links Among the Tools



Design Intent Documentation

- Today's design intent documentation is fragmented, at best.
- Value:
  - Consolidates, preserves, updates information
  - Engages owner & team
  - Avoids misunderstandings
  - Supports commissioning
  - Establishes and tracks performance targets
  - Enhances energy savings, O&M, M&V

Building Lifecycle

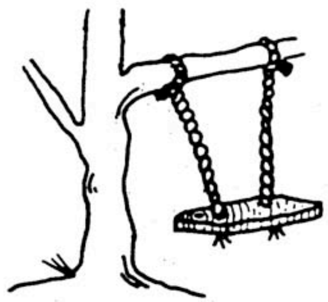


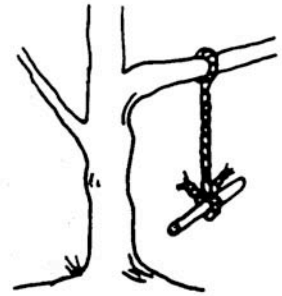
Challenges

- Effective owner involvement
- Highly diverse user audiences
- Tension between brevity and comprehensiveness
- Integrating with existing design culture
- Resistance to documentation

If it Wasn’t So True, it Would Be Funny

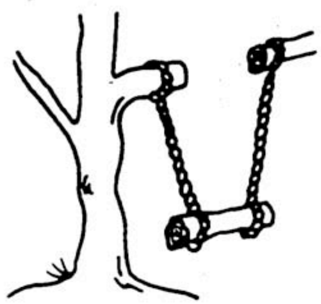
What the user really wanted

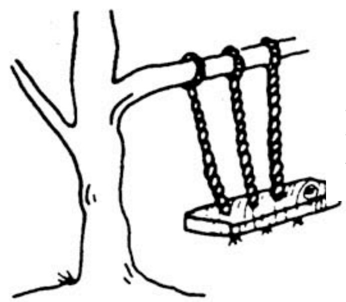




What the user asked for

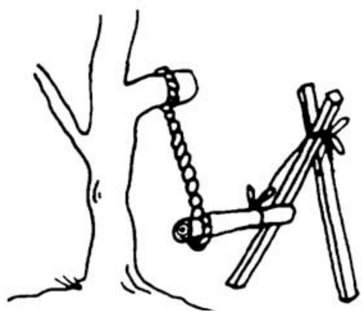
How the analyst saw it

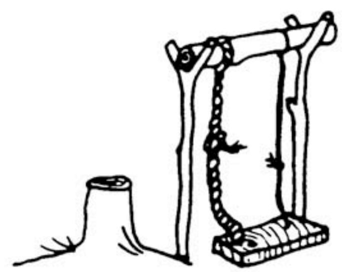




How the system was designed

As the contractor built it



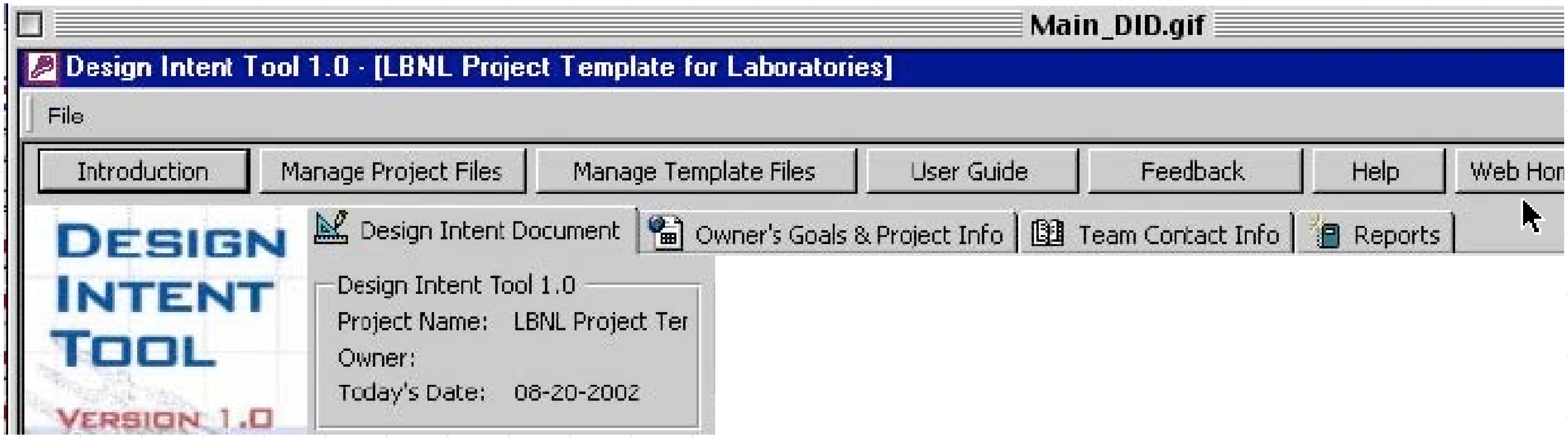


How it actually works (Mondays)

Approach

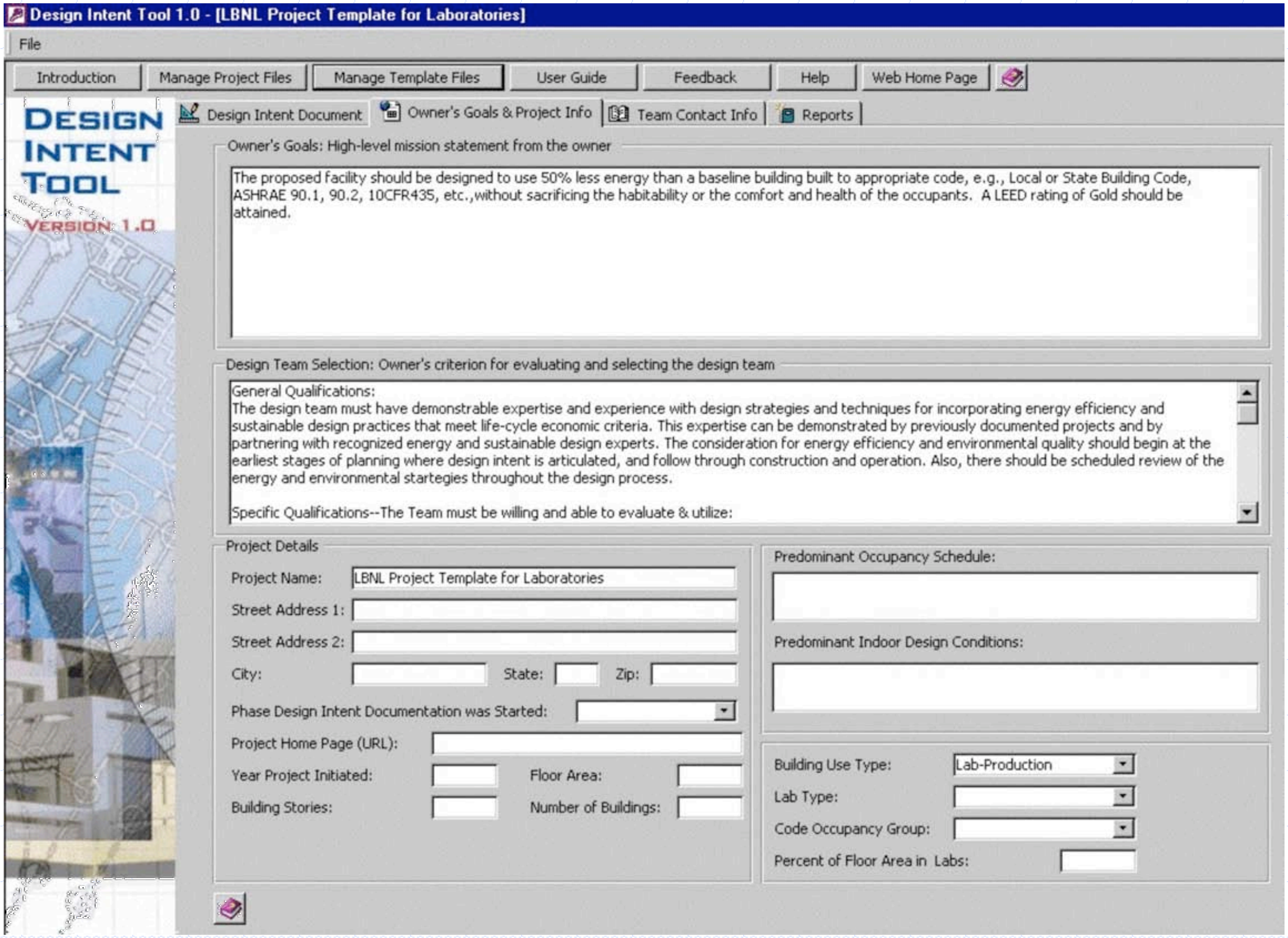
- Structure
  - Design Areas
    - Objectives - overall goals
      - Strategies - methods for achieving goals
      - Metrics - how to confirm/verify performance
- Database-driven, Access2000, Outputs to Word & Excel
- Templates from LBNL (Labs; LEED Bldgs)
- Web connectivity
- “Local” content (e.g. EE Labs Design Guide)

Navigation



Main_DID.gif
Design Intent Tool 1.0 - [LBNL Project Template for Laboratories]
File
Introduction
Manage Project Files
Manage Template Files
User Guide
Feedback
Help
Web Hor
DESIGN INTENT TOOL
VERSION 1.0
Design Intent Document
Owner's Goals & Project Info
Team Contact Info
Reports
Design Intent Tool 1.0
Project Name: LBNL Project Ter
Owner:
Today's Date: 08-20-2002

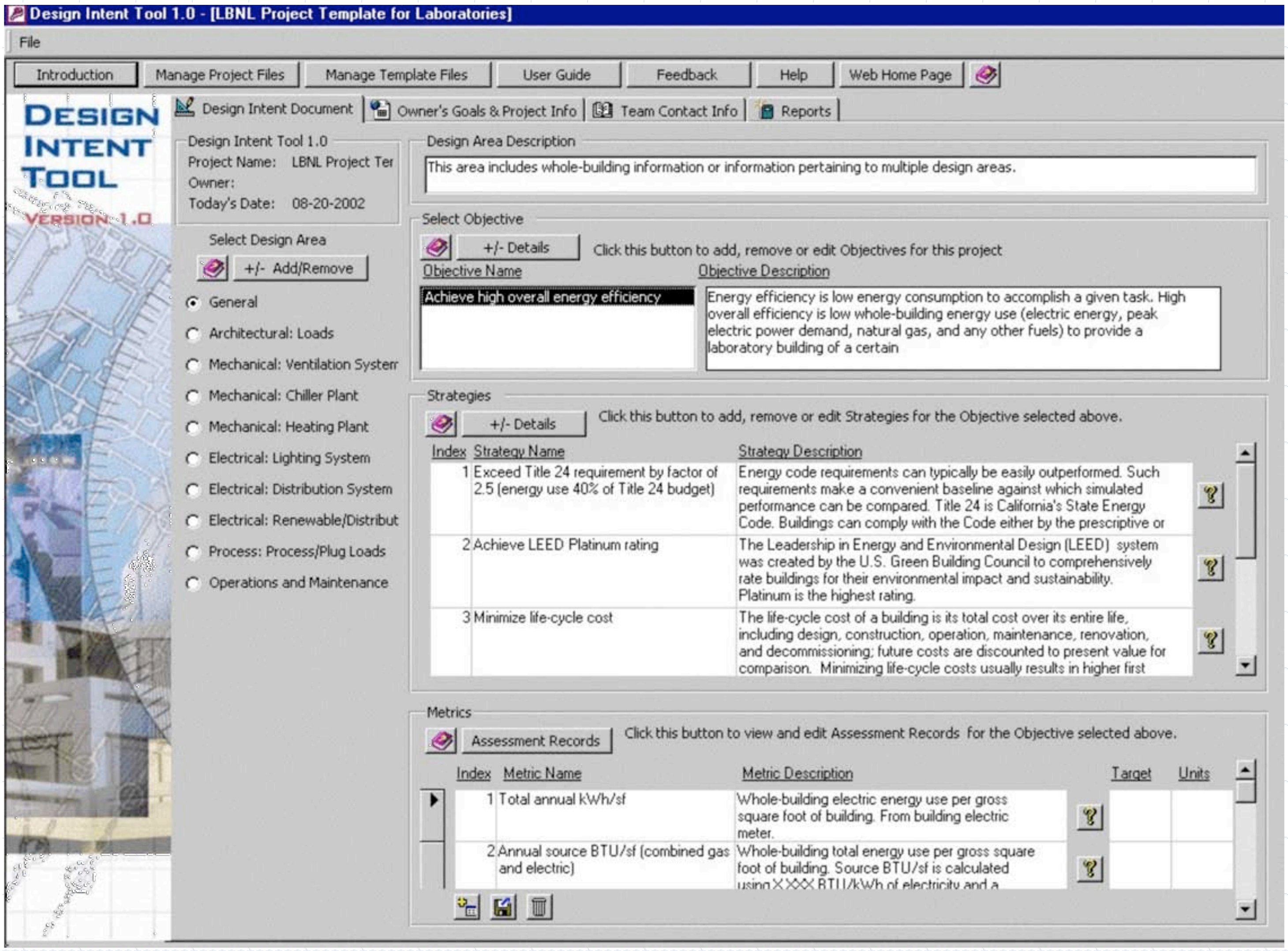
Owner’s Goals



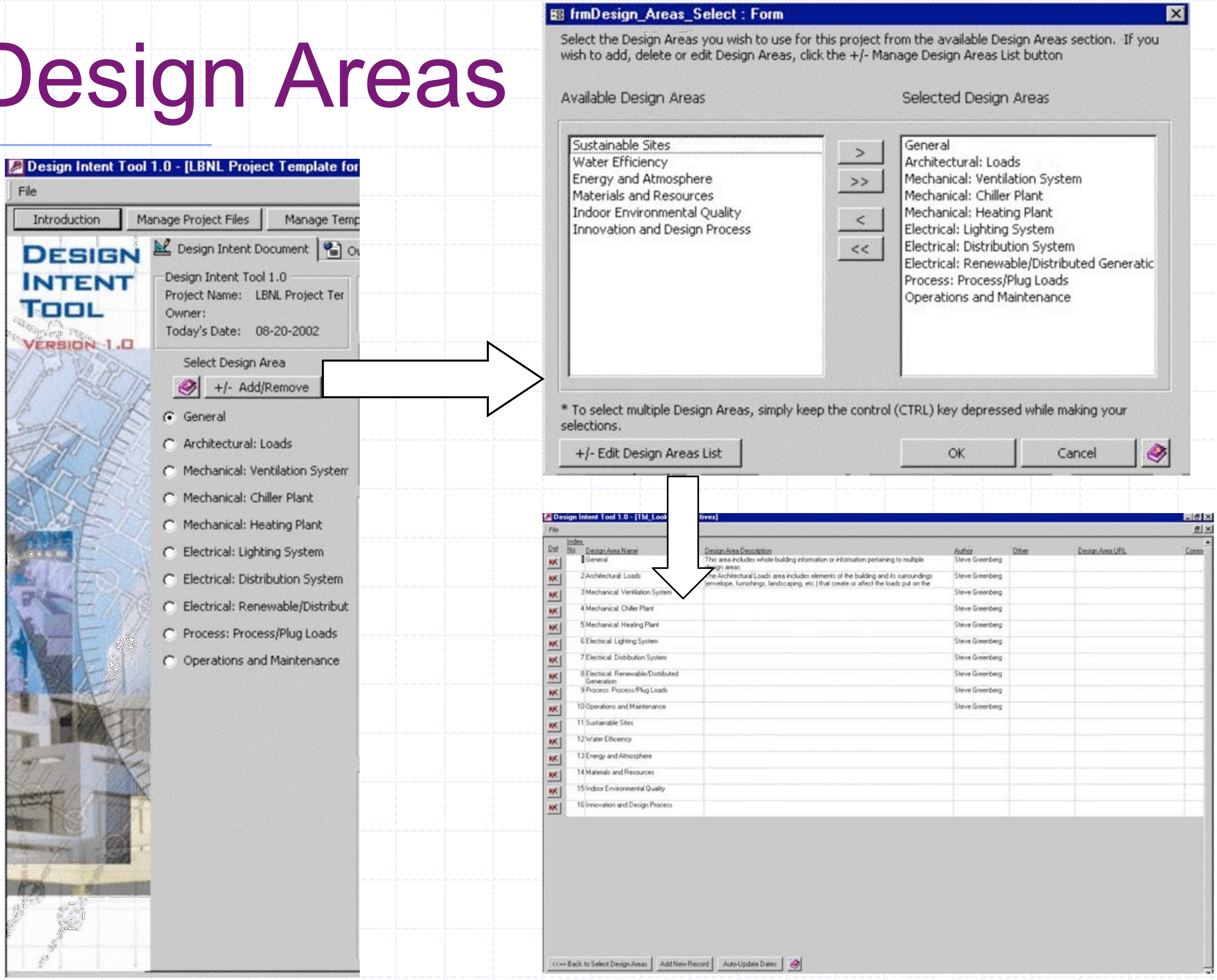
UC Merced UC Merced Science & Engineering Building Case Study

- 166,000 sq.ft. Teaching/Research Lab
- Owner's Goals
  - The proposed facility should be designed to use 20% less energy than a baseline building, without sacrificing the habitability or the comfort and health of the occupants. A LEED rating of Silver should be attained.

Design Intent Document



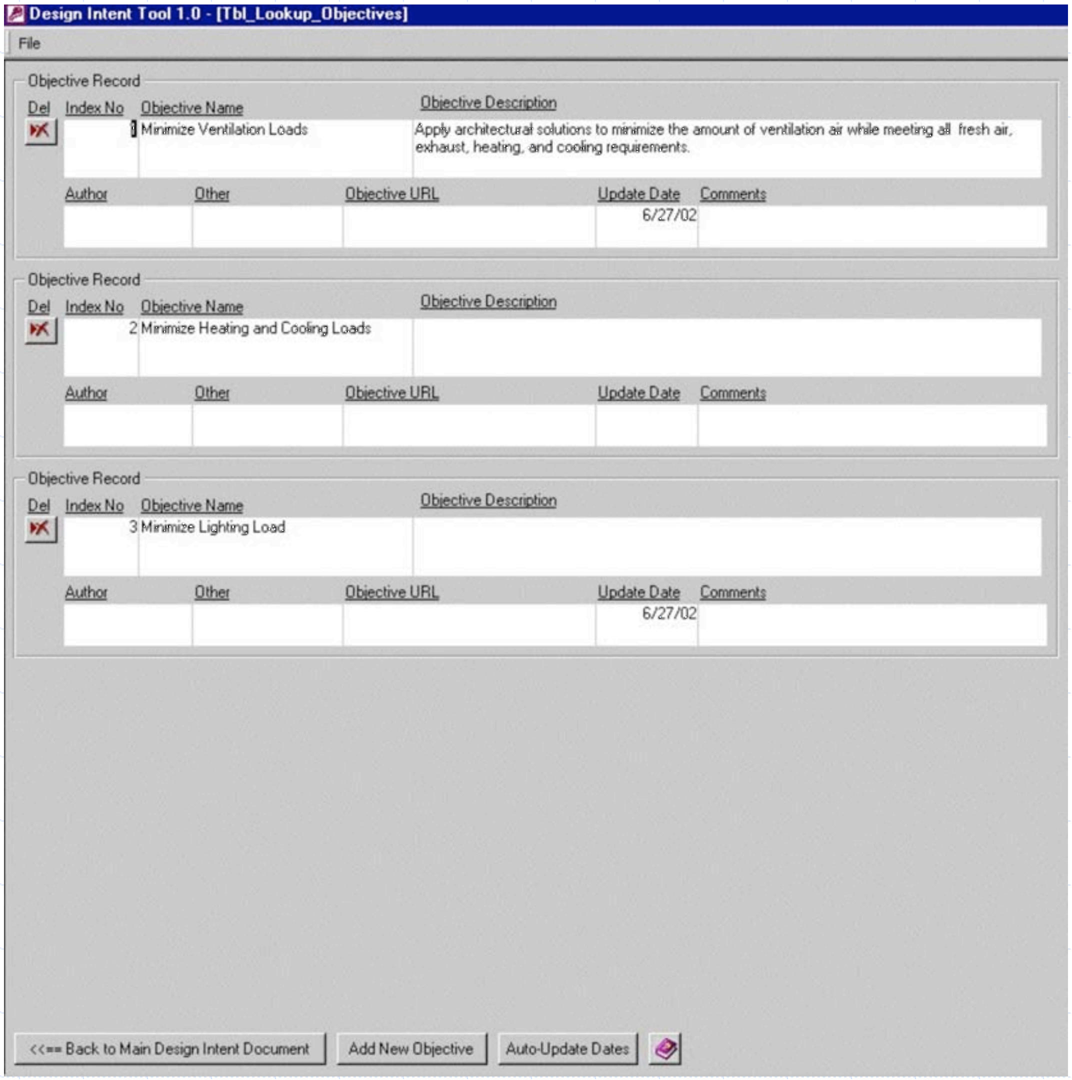
Design Areas



UC Merced - Design Areas

- General
- Architectural
- Mechanical: Ventilation
- Mechanical: Chiller (central plant)
- Mechanical: Heating (central plant)
- Electrical: Lighting
- Electrical: Distribution
- Process/Plug Loads
- Operation and Maintenance
- Energy Monitoring and Controls (added)

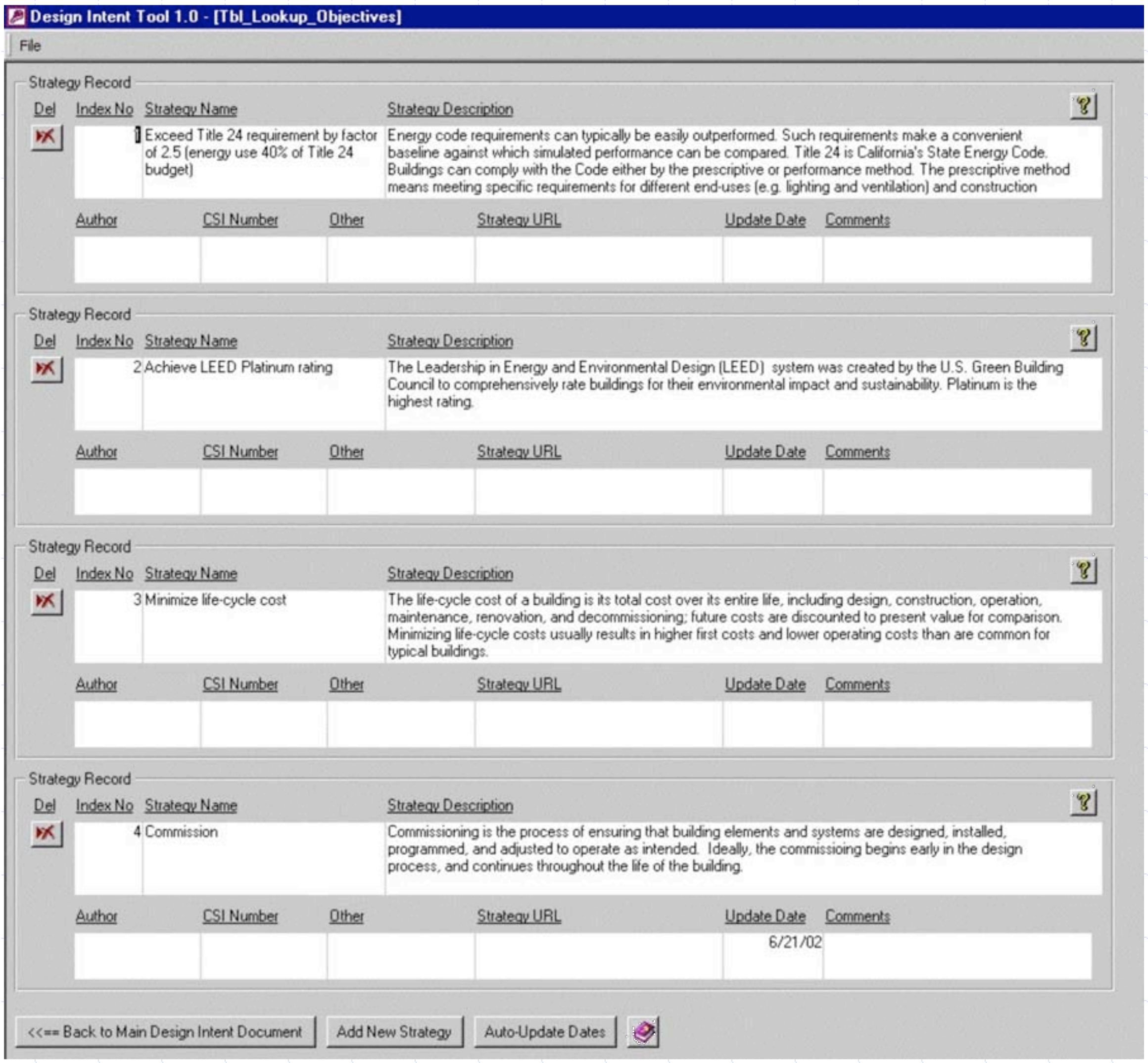
Objective Details



UC Merced - Key Objectives

- 26 “High Level” Objectives
- Key Objectives
  - Achieve high overall energy efficiency
  - Minimize ventilation loads
  - Maximize average and MLM efficiency
  - Minimize peak electric load
  - Minimize simultaneous heating and cooling
  - Assure ongoing performance

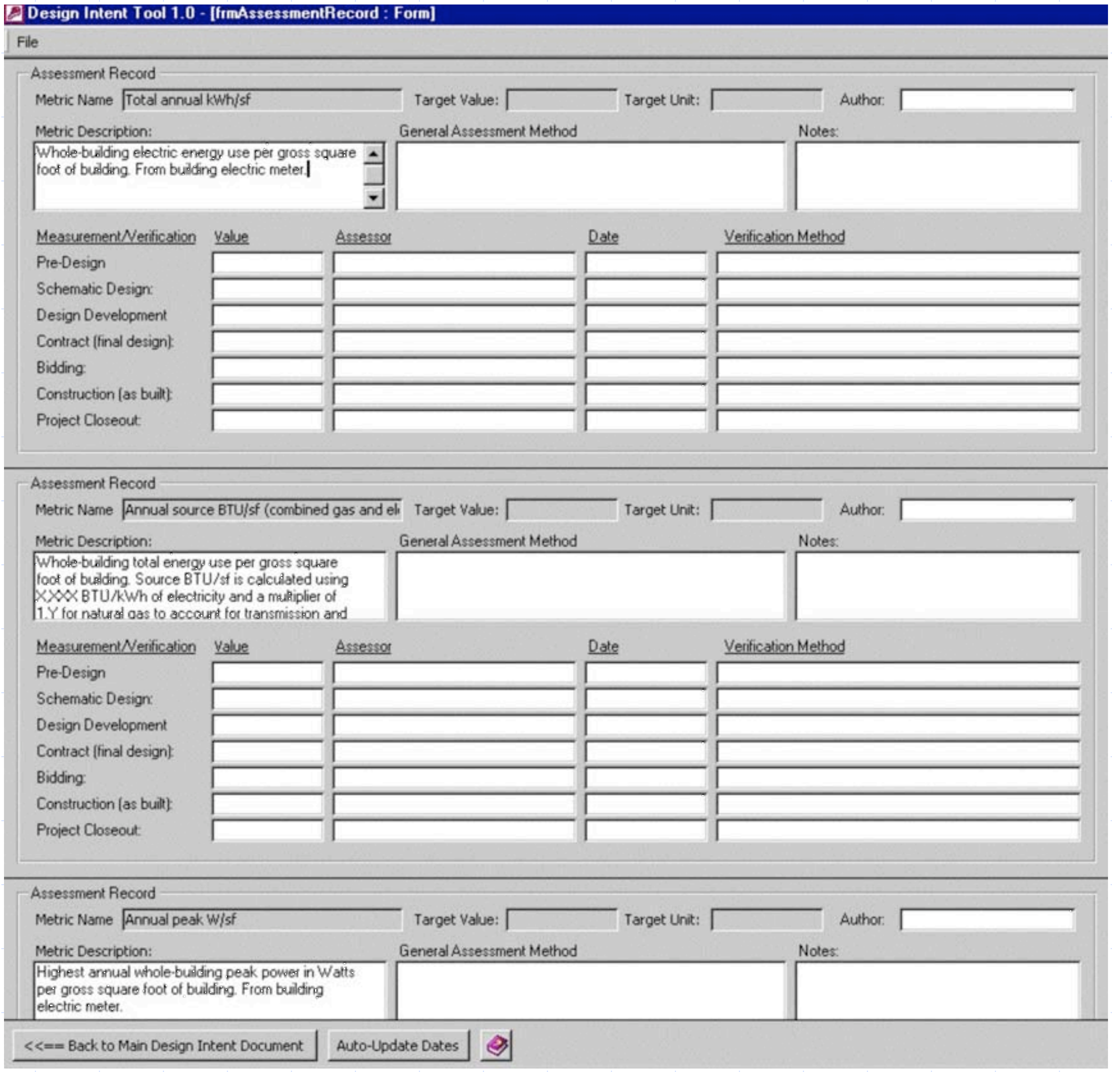
Strategy Details



UC Merced - Key Strategies

- Over 100 Strategies to Achieve Goals
- Key Strategies
  - VAV fume hoods
  - VFDs on fans and pumps
  - Low pressure drop design (maybe)
  - Evaporative precooling and process cooling
  - Cooling coils in zones (no reheat)
  - Central plant TES
  - Ventilation and temperature reset (occ. sensor)

Assessment Record



UC Merced -- Key Metrics

		Target	
Design Area:	General		
Metric:	Total annual kWh/sf	33 KWh/sf	
Metric:	Annual peak W/sf	5.3 W/sf	
Design Area:	Architectural: Loads		
Metric:	Peak lab-only exhaust cfm/NSF	1 cfm/Nsf	
Design Area:	Mechanical: Ventilation System		
Design Area:	Mechanical: Chiller Plant		
Metric:	Peak cooling tons/Ksf	2.9 tons/Ksf	
Design Area:	Mechanical: Heating Plant		
Metric:	Annual heating BTU/sf	150,000 BTU/sf	
Metric:	Peak heating BTU/hr/sf	34 btu/hr/sf	
Design Area:	Electrical: Lighting System		
Metric:	Peak lighting W/sf	1.1 W/sf	

Report Options

REPORT GENERATOR - PICK ONE	Overview & Owner's Objectives	Basic Design Intent Document	Full Design Intent Document	Specifications Report	Metrics & Measurements	Data Tracker
General						
Design Intent Documentation Overview (Boilerplate text to be provided by Evan)	•	•	•	•	•	
Project Info fields	•	•	•	•	•	•
Team Contact Info fields	•	•	•	•	•	•
Owner's Goals field	•	•	•			
Design Team Selection field	•	•	•			
Core Design Intent Document						
Design Areas	•	•	•	•	•	•
Objectives	•	•	•		•	
Strategies		•	•	•		
CSI Number			•	•		
Metrics (with target values)		•	•		•	•
Assessment Records			•		•	•
Comments			•			
Date of entry			•			
URL			•			
Author	•	•	•	•	•	•
User-defined Index Number		•	•			
Other			•			
FILE FORMAT	Word	Word	Word	Word	Word	Excel

Download

http://ateam.lbl.gov/DesignIntent/home.html

- New Templates
- User Guide
- Updates